Claims

1. An implantable bone paste composition comprising gelatin as a carrier for substantially bioabsorbable osteogenic components for use in a recipient in need thereof.

2. The bone paste of claim 1 for use in the repair of non-union fractures, periodontal ridge augmentation, craniofacial surgery, arthrodesis of spinal or other joints, spinal fusion procedures, and implant fixation.

3. The composition of claim 1 wherein the gelatin is thermally cross-linkable at or slightly above the temperature of the organism into which it is to be implanted.

4. The composition of claim 3 wherein said composition gels at about 38°C.

5. The composition of claim 3 wherein said gelatin is present at a concentration of between about 20-45% (w/w) gelatin as a fraction of the weight of the composition.

6. The composition of claim 5 wherein the osteogenic component is selected from the group consisting of:

(i) demineralized bone matrix (DBM);

(ii) bioactive glass ceramic, BIOGLASS®, bioactive ceramic, calcium phosphate ceramic, hydroxyapatite, hydroxyapatite carbonate, corraline hydroxyapatite, calcined bone, tricalcium phosphate, or mixtures thereof;

(iii) bone morphogenetic protein, TGF-beta, PDGF, or mixtures thereof, natural or recombinant; and

(iv) mixtures of (i)-(iii).

7. The composition of claim 6 wherein the gelatin, the demineralized bone matrix, or both are derived from the species into which the bone paste is to be implanted.

8. The composition of claim 7 wherein DBM is present at between about 0-40% (w/w) of the total ~~composite~~ composition weight.

9. The composition of claim 8 wherein DBM is present at between about 15-33% (w/w) of the total ~~composite~~ composition weight.

10. The composition of claim 6 wherein the bioactive glass is BIOGLASS®.

11. The composition of claim 6 wherein component (ii) is present at between about 0-40% (w/w) of the total composition mass.

12. The composition of claim 6 comprising antibiotics, bone morphogenetic proteins ~~or other proteins~~, whether derived from natural or recombinant sources, wetting agents, glycerol, carboxymethyl cellulose (CMC), growth factors, steroids, non-steroidal anti-inflammatory compounds, or combinations thereof.

13. The composition of claim 6 comprising between about 0.0001 to 0.1 mg/ml bone morphogenetic protein.

14. The composition of claim 1 which is a frozen solution or is freeze-dried.

15. The composition of claim 1 wherein the gelatin is human, bovine, ovine, equine, canine or mixtures thereof.

16. The composition of claim 1 wherein the gelatin is derived from human collagen sources via enzymatic, acid or alkaline extraction.

17. The composition of claim 16 wherein said human collagen sources are human skin, bone, cartilage, tendon, connective tissue, or mixtures thereof.

18. The composition of claim 17 produced by treating the collagen source with pepsin at about 33°C, heat denaturing the thus treated collagen under controlled conditions to produce gelatin, and mixing the thus produced gelatin with an osteogenic compound such that the gelatin is present at a final concentration of about 20-45% (w/w).

19. The composition of claim 18 wherein the denaturation is achieved by heating to at least 50°C.

20. The composition of claim 19 wherein the gelatin has a molecular weight of greater than about 50,000 daltons.

21. The composition of claim 1 wherein the osteogenic component is demineralized bone matrix in a powdered form, and is composed of particles in the size range between about 80-850 μm in diameter.

22. The composition of claim 21 comprising about 0-40% (w/w) demineralized bone matrix powder, provided that if the demineralized bone matrix is powder is absent, then a bone growth factor is present at a concetration of at least 0.0001 mg/ml.

23. The composition of claim 22 wherein said bone growth factor is morphogenetic protein, TGF-ß, PDGF, or mixtures thereof, natural or recombinant.

24. The composition of claim 6 wherein the bioactive glass is BIOGLASS® having a diameter of between about 0.5-710 μm.

25. The composition of claim 1 further comprising cortical, cancellous or cortical and cancellous bone chips.

26. The composition of claim 25 wherein said bone chips are in the size range of 80μm to 10 mm.

27. The composition of claim 1 which is injection molded, vacuum molded, rotation molded, blow molded, extruded or otherwise formed into a solid form.

28. The composition of claim 27 wherein said form is selected from vertebral disks, acetabular hemispheres, tubes, ellipsoid, oblong, and "U" shapes for void filling, intramedullary plug formation, and impaction grafting.

29. A method for inducing bone formation *in vivo* in a recipient in need thereof which comprises implanting an effective amount of an implantable bone paste composition comprising gelatin as a carrier for substantially bioabsorbable osteogenic components.

30. The method claim 29 which comprises repairing non-union fractures, achieving periodontal ridge augmentation, conducting craniofacial surgery, securing implants, arthrodesis of spinal or other joints, spinal fusion procedures, or impaction

grafting, which comprises implanting said composition at the site *in vivo* in need of such treatment.

31. The method according to claim 30 which comprises formation of a series of small apertures in an interverterbral space and injection of said composition into said space to induce artherodesis.

32. The method according to claim 30 which comprises extruding said composition from a syringe at a temperature at a first temperature at which it remains liquid or highly maleable, and forming a resilient, sticky and easily formable shape from said composition as it gels at a second temperature at or slightly above the body temperature of the organism into which it is implanted.

33. A method for making an implantable graft which comprises preparing a composition comprising a thermally cross-linkable gelatin carrier and suspending therein a substantially bioabsorbable osteogenic component.

34. The method of claim 33 wherein said osteogenic component is selected from:

(i) demineralized bone matrix (DBM);

(ii) bioactive glass ceramic, BIOGLASS®, bioactive ceramic, calcium phosphate ceramic, hydroxyapatite, hydroxyapatite carbonate, corraline hydroxyapatite, calcined bone, tricalcium phosphate, or like material;

(iii) bone morphogenetic protein, TGF-ß, PDGF, or mixtures thereof, natural or recombinant; and

(iv) mixtures of (i)-(iii).

35. The method of claim 34 which further comprises injection molding, vacuum molding, rotation molding, blow molding, extruding ~~or otherwise forming~~

said composition into the desired form of a solid graft, and allowing the composition to solidify at a temperature at which the gelatin becomes thermally cross-linked.

36. The method of claim 35 wherein said form is selected from vertebral disks, acetabular hemispheres, tubes, ellipsoid, oblong, and "U" shapes for void filling, intramedullary plug formation, and impaction grafting.

37. The method of claim 36 which comprises raising the temperature of the composition above its liquefaction temperature and allowing the composition to gel in a mold of appropriate shape.